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China Report

SCIENCE AND TECHNOLOGY

No. 137

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CHINA REPORT

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APPLIED SCIENCES

NINTH ARTIFICIAL SATELLITE SUCCESSFULLY LAUNCHED

Beijing BEIJING WANBAO in Chinese 23 Sep 81 p 2

[Article by Jiang Bin [3068 2430] of the Chinese Institute of Space Technology: "China's Ninth Artificial Satellite"]

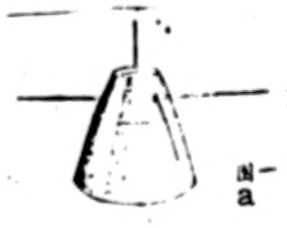
[Text] It was early morning on 20 September. A huge carrier rocket slowly rose over China, dragging a long flame at its tail. It first ascended vertically and then made a gradual turn and quickly disappeared into the sky. This marked the successful launching of China's ninth artificial satellite. It was named "Scientific Experiment Satellite No 9" or "SWK-9" for short.

Scientific Experiment Satellite No 9 consists of a collection of three satellites. A single carrier satellite was employed in this launch and three satellites were delivered into orbit simultaneously. This space technology is known as the "single-rocket multiple-satellite technique."

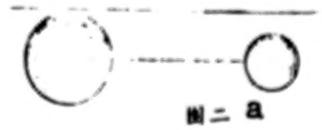
The orbits of the three satellites are approximately the same: the perigee is at 240 kilometers, the apogee is at 1610 kilometer, the angle between the orbit plane and the earth equatorial plane is 59.5 degrees and they revolve around the earth every 103 minutes.

Each satellite has its unique shape. The heaviest of the three has the shape of a truncated cone, (see Figure 1) and consists of two trucated cones joined together with the appearance of a suspended bell. Rod-shaped resonator antennas extend from the top surface and the side wall of the upper truncated cone. Once in orbit, the satellite continuously emits radiowaves at 40 MHz and 160 MHz. The lightest of the three satellites is spherical in shape and consists of a metal sphere and a balloonconnected by a thin wire, as shown in Figure 2.

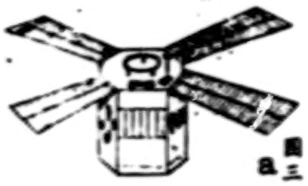
a--Figure 1



a--Figure 2



The third satellite is the main body of the Scientific Experiment Satellite No 9 and is shaped like an octagon, 1.1 meters high, and the diameter of the exterior is 1.2 meters, see Figure 3.



a--Figure 3

Four rectangular solar cell panels are symmetrically attached on the edges of the octagon. These panels convent the received solar energy into electrical energy and supply power to various electronic equipment on board.

The principal mission of SKW-9 is high altitude physical exploration. The satellite is equipped with more than 10 detecting devices: some measure the atmospheric density at the satellite location, some detect infrared and ultraviolet radiation emitted from the earth-atmosphere system, some measure the quantity and energy of high altitude protons and electrons and still others specifically detect the x-ray and ultraviolet radiation of the sun. Data obtained in this exploration will serve as background data on space environment in the development of China's space technology and will also provide preliminary conditions for China's space physics research.

Once the satellite enters its flight orbit, the radio remote control system goes to work. Using a 480 MHz carrier, signals containing high altitude physical data and satellite flight engineering data such as satellite attitude in orbit and interior temperature of the satellite are constantly transmitted. These parameters are used to modulate the 480 MHz radio carrier wave. Once these signals are received on the ground, a smoothing process quickly reveals the variation of the physical quantities on the satellite. This technique is known as "real-time remote sensing".

Since the radiowaves propagate along a straight line, we can no longer receive them once the satellite has moved away from the sky above China. To counter this, the satellite is equipped with a "memory device" which records the signals as they occur and then, when the satellite is over China again, transmits the signals via a 180 MHz carrier. The data received by the ground station were actually measured by the satellite some time earlier; hence, the technique is known as "delay-time remote sensing". Scientific Experiment Satellite No 9 has both real-time and delay-time remote sensing capabilities, which allows us to obtain data measured over the entire globe.

9698
CSO: 4008/11

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

ANNOUNCEMENT OF MEETING OF CHINESE AND AMERICAN GEOPHYSICISTS

Baoding SHIYOU DIQIUWULI KANTAN [OIL GEOPHYSICAL PROSPECTING] in Chinese No 4, 1981 p 36

[Article: "Joint Academic Meeting of Chinese and American Geophysicists Will Be Held in Beijing"]

[Text] A joint academic meeting sponsored by geophysicists of both China and the United States will be held in Beijing in September, 1981. The main subject to be discussed is geophysical prospecting for oil and gas, including
--ease histories,
--methods and ideas for solving difficult geophysical problems,
--geophysical theories and philosophies,
--studying the structure of sedimentary basins by using geophysical data,
--seismic stratigraphic studies and their related special processing of data, and
--developments and applications of new methods and new techniques.

Forty representatives from each side will be present and 35-40 papers will be read at the meeting by each group. The meeting is scheduled to last five days. During the meeting, the American representatives will be invited to visit the Data Processing Center of the Geophysical Research Institute of China National Oil and Gas Exploration and Development Corporation and the geophysical exploration exhibition sponsored by the Society of Petroleum Geophysicists.

9717
CSO: 4020/2

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

SOCIETY OF PETROLEUM GEOPHYSICISTS INTRODUCED

Baoding SHIYOU DIQIUWULI KANTAN [OIL GEOPHYSICAL PROSPECTING] in Chinese No 4, 1981 p 94

[Article: "Brief Introduction to the Society of Petroleum Geophysicists"]

[Text] The Society of Petroleum Geophysicists (SPG) is established for the purpose of raising the level of its members' technological knowledge and of developing the petroleum geophysical industry of China.

In the council of the society there are honorary presidents, president, vice-presidents, secretary-general, vice secretaries-general and directors. They, except for the honorary presidents, form a standing committee to exercise the authority of the council.

The society will hold a relatively large anniversary meeting and some forums on techniques each year. It will also offer some training courses and conduct some academic activities.

SPG publishes a bimonthly journal called OIL GEOPHYSICAL PROSPECTING which reports new techniques and new ideas on petroleum geophysics. SPG has a department of materials and literatures.

The leading members of the council are:

GU Gongxu [7357 0501 0650]	honorary president, geophysicist
FU Chengyi [0265 2110 5030]	honorary president, geophysicist
WENG Wenbo [5040 2429 3134]	honorary president, geophysicist
LIN Yungen [2621 6663 2704]	president, geophysicist
PAN Yuan [3382 3850]	vice-president, geophysicist
LU Banggan [7120 6721 1626]	vice-president, geophysicist
ZHU Dashou [2612 1129 2219]	vice-president, geophysicist
CHU Shaoliang [0328 4801 5328]	vice-president, geophysicist
YU Xisheng [0060 6932 0524]	secretary-general, geophysicist
YU Zhanyuan [0060 0594 0337]	vice secretary-general, geophysicist
WANG Jingyu [3769 2529 3558]	vice secretary-general, geophysicist
CHEN Junsheng [7115 0193 3932]	editor-in-chief, director of the department of material and literature, geophysicist

Address of the council: P.O. Box 11-1, Zhuoxian, Hebei, PRC

9717
CSO: 4020/2

Engineering

AUTHOR: JIANG Mingqian [5592 2494 6197]
LI Sen [2621 2773]
ZHANG Jiancheng [1728 1696 2052]
LIU Jinhui [0491 6930 1979]

ORG: JIANG of the Institute of Chemistry, Chinese Academy of Sciences, Beijing; LI of Tongji University; ZHANG and LIU both of the Institute of Photochemistry and Photographic Science, Chinese Academy of Sciences, Beijing

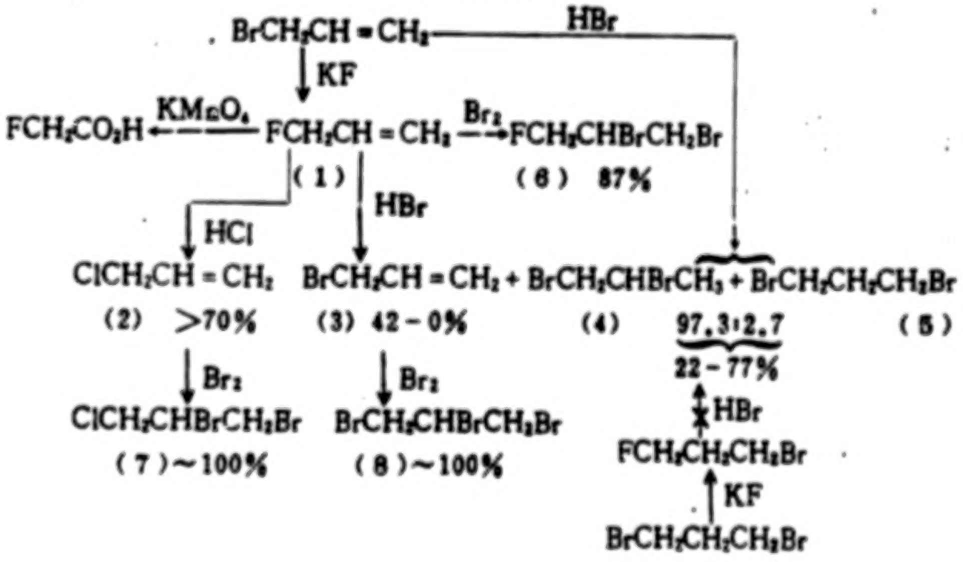
TITLE: "The Activity of the Fluorine Atom in 3-Fluoropropylene. I. The Halogenation Reaction of 3-Fluoropropylene"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 1-6

TEXT OF ENGLISH ABSTRACT: The substitution of halogen atom in halo-hydrocarbon by its lighter colleague is a normal process and is utilized extensively for the preparative purpose. Alternatively, the reverse processes, i.e., the heavier colleagues substitute for the lighter ones, take place more difficultly and hence are rather rare. Until now, fluoro-benzene has been the only fluoro-hydrocarbon known that can be substituted for by chlorine or bromine. We believe that such a reverse substitution process depends not only on the kind of halogen atom, but also on the molecular structure to which the halogen atom is attached. If one could design a molecular structure of halo-hydrocarbon in which the halogen atom was

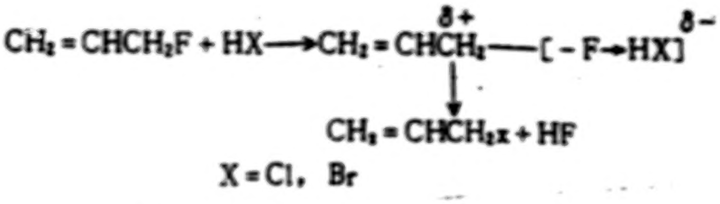
[Continuation of TONGJI DAXUE XUEBAO No 3, 1981 pp 1-6]

active enough, the reverse substitution reaction would proceed smoothly. This is the case. It is indeed found that the reaction between allyl fluoride and hydrogen halide (here the halogen = chlorine or bromine), under the typical ionic addition-reaction condition, is the substitution of fluorine by chlorine or bromine rather than the addition of hydrogen halide to the ethylenic double bond, due to the activity of the fluorine atom attached to the allylic position. The results are summarized in the following scheme:



[Continuation of TONGJI DAXUE XUEBAO No 3, 1981 pp 1-6]

A substitution-reaction mechanism including a n-complex intermediate, as shown below, has been tentatively suggested:



$$CH_2=CHCH_2F+HX \longrightarrow CH_2=CH\overset{\delta+}{C}H_2—[-F\rightarrow HX]^{\delta-} \downarrow CH_2=CHCH_2x+HF$$

$X=Cl,\ Br$

AUTHOR: YAN Deyue [7346 1795 1471]

ORG: Tongji University

TITLE: "Progress in the Theoretical Study of Configurational Sequence of Vinyl Polymers. I. Atactic Polymerization and Bernoullian Process"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 7-15

TEXT OF ENGLISH ABSTRACT: The statistical theory of stereo-configurational sequence distribution of vinyl polymers is reviewed comprehensively. Various Markovian probabilities of mult-ads are singled out. A lot of relationships among the frequencies of occurrence of n-ads with different configurations, based on analysis of the probabilities listed already, are obtained. The results derived from statistics are checked by means of non-steady state kinetics. The first part of this series, i.e., the present paper, deals with the atactic polymerization and Bernoullian process. A set of decision equations for the Bernoullian trial model is derived. With the aid of these decision equations, Bovey's plot is simplified into a straight line. It is found that, for the Bernoullian process, the points resulting from the experimental data of NMR conform with the standard line within the experimental error in the decision plots; on the other hand, when these points deviate from the standard line outside the experimental error, the relative polymerization must be a Markovian process. For instance, the predominant syndiotactic

[Continuation of TONGJI DAXUE XUEBAO No 3, 1981 pp 7-15]

PMMA is generated by radical polymerization or anionic polymerization in polar solvents, of which the stereo-specificity follows the Bernoullian trial model; alternatively, the predominant isotactic PMMA, which fits in with the Markovian trial model, is produced with anionic polymerization in non-polar solvents, or in polar solvents using C_s^+ as the counter ion, or with radical polymerization in solid state. In the next paper, the Markovian processes will be discussed.

AUTHOR: SHI Meilun [0670 5019 0243]

ORG: Tongji University

TITLE: "Electrochemistry on Fermi Surfaces. I. Qualitative Features"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 16-23

TEXT OF ENGLISH ABSTRACT: The concept of the Fermi Surface in momentum space, which is directly derived from quantum statistical mechanics as it is used in metal physics and which is now in wide use far beyond the scope of solid state physics, is now considered to be of fundamental importance in elucidating the quantum statistical nature of electrode potential in electrochemistry. Based on the concept of the Fermi Surface, the nature of the electrode potential and hence the redox potential has been associated with the parameter μ in Fermi-Dirac statistics, the potential of zero charge has been related to the radius of the naked Fermi sphere in the solid phase, and the double layer capacitance may be evaluated by the concentration of electrons beyond the Fermi surface. The exchange current and the electrode kinetics have also been discussed. The difference between the ideal polarized electrode and the ideal non-polarized electrode has been associated with the possibility of potential modulation of the electrode to change the radius of Fermi sphere.

[Continuation of TONGJI DAXUE XUEBAO No 3, 1981 pp 16-23]

All the electrochemical processes, including corrosion and passivation, can be clearly understood in terms of Fermi surfaces. An electrochemical cell may be regarded as two Fermi spheres which are in contact with each other. In case of nonequilibrium, electrons flow from one of the two Fermi spheres to the other, and consequently fall through one of the Fermi surfaces into the Fermi sea, and simultaneously the same amount of electrons will escape from the other Fermi sphere and compensate for the loss of the electrons in the former process. The former process is called the cathodic process while the latter is called the anodic process. Thus the cathodic and anodic currents originate from the redistribution of electron states near the Fermi surfaces.

Tafel's equation has been obtained by evaluating electron populations beyond the Fermi sphere.

AUTHOR: LING Yongyong [5677 6978 6978]

ORG: Tongji University

TITLE: "On the Generalization of C.N. Yang's Equation--The Generalized Gravitational Gauge Field Equations"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 24-32

TEXT OF ENGLISH ABSTRACT: The asymptotic solutions with spherical symmetry, static metric to the generalized C.N. Yang's equation $R_{ik;l} + \Lambda R_{il;k} = 0$ have been obtained. Our approximate solution for $\Lambda \neq -1$, $\Lambda \neq -2$ simultaneously is the Schwarzschild solution, that for $\Lambda = -2$ is similar to the Reissner-Nordström metric, and that for $\Lambda = -1$ is the solution of C.N. Yang's gravitational gauge field. Namely

$$ds^2 = -\left[1 - \frac{a}{r} + 0\left(\frac{1}{r}\right)\right]dt^2 + \frac{dr^2}{1 - \frac{a}{r} + 0\left(\frac{1}{r}\right)} + r^2(d\theta^2 + \sin^2\theta\, d\varphi^2), \Lambda \neq -1, \Lambda \neq -2$$

$$\left.\begin{aligned} ds^2 &= -\left(1 - \frac{a}{r}\right)dt^2 + \frac{dr^2}{1 - \frac{a}{r} + \frac{c^2}{8r^2}} + r^2(d\theta^2 + \sin^2\theta\, d\varphi^2) \\ ds^2 &= -\left(1 - \frac{a}{r} + \frac{a^2}{8r^2}\right)dt^2 + \frac{dr^2}{1 - \frac{a}{r}} + r^2(d\theta^2 + \sin^2\theta\, d\varphi^2) \\ ds^2 &= -\left(1 - \frac{a}{r} + \frac{a^2}{8r^2}\right)dt^2 + \frac{dr^2}{1 - \frac{a}{r} + \frac{a^2}{4r^2}} + r^2(d\theta^2 + \sin^2\theta\, d\varphi^2) \end{aligned}\right\} \quad \Lambda = -2$$

[Continuation of TONGJI DAXUE XUEBAO No 3, 1981 pp 24-32]

$$ds^2 = -\left[1 - \frac{b}{r} + 0\left(\frac{1}{r}\right)\right] dt^2 + \frac{dr^2}{1 - \frac{a}{r} + 0\left(\frac{1}{r}\right)} + r^2(d\theta^2 + \sin^2\theta d\varphi^2), \ \Lambda = -1.$$

Three pairs of equivalence conditions for the generalized C.N. Yang's equation and for the divergence equations of the energy-momentum tensor are derived by using Einstein's gravitational field equation. For the special case of $\Lambda = -1$, our theorem coincides with one of those in C.N. Yang and Gu Chaohao's theory of the gravitational gauge field.

AUTHOR: JIN Ruichun [6855 3843 2797]
LIU Yongren [0491 3057 0086]
CHEN Xuechao [7115 1331 3390]

ORG: All of Tongji University

TITLE: "On the General Purpose Wavefront Method"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 33-43

TEXT OF ENGLISH ABSTRACT: When the wavefront method is used to solve some large structures, a difficulty will arise if the stiffness matrices of the wavefront are too large to be entirely stored in the main memory. The difficulty can be overcome by using the general purpose wavefront method, a new variety of the well-known wavefront method. When this method is used, a part of the stiffness matrices of the wavefront may be stored in the file memory so that there is no limit to the size of the stiffness matrices of the wavefront, and some particular techniques are used to manage the operations and the input-output. These techniques, stated in paragraphs §2-§7 of this paper, include the organization of locations, the assemblage process of the element matrices to the structure matrices, the generation of the unit pivot lows, the reduction of the stiffness matrices of the wavefront, the elimination and management of wavefront variables. The flowcharts of

[Continuation of TONGJI DAXUE XUEBAO No 3, 1981 pp 33-43]

the main operations for this method are given. The time spent on input-output is evaluated. Finally, the results of a practical example are given and compared with those of other methods and experiments.

AUTHOR: YAO Zukang [1202 4371 1660]

ORG: Tongji University

TITLE: "Thermal Warping Stresses in Concrete Pavements"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 44-54

TEXT OF ENGLISH ABSTRACT: The thermal warping stresses in concrete pavements resting on semi-infinite continuum were analyzed by the finite element method and, as a result, the curves of warping stress coefficients against relative length (or width) were plotted.

The noncontact phenomena of slabs with Winkler foundation and semi-infinite continuum while warping and the warping stress changes as the influences of noncontact being considered were also analyzed. It was found that the area of noncontact and its gap would become greater as the slab shortened, the temperature gradient increased and the relative stiffness of the slab decreased, but they would be much smaller when the wheel load acted. The noncontact phenomenon of slab with Winkler foundation was more severe than that with semi-infinite continuum. The warping stress would be lower when the negative (downward) reaction of the foundation was discarded. It was clear that the warping stresses of shorter slabs ($\leq 6m$) are overestimated by Westergaard's theory as the influence of noncontact is not considered.

AUTHOR: ZHENG Guoquan [6774 0948 2938]

ORG: Tongji University

TITLE: "A Primary Suggestion for Using the 'Cord Offsetting' Instead of 'Tangent Offsetting' to Determine the Coordinates of the Perspective Views of a Freeway"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 55-67

TEXT OF ENGLISH ABSTRACT: In using the cord offsetting method, which includes the corrections of angles of radial cross sections and cross sections themselves, to determine the coordinates of the perspective views of a freeway, the protractor would no longer be needed. Therefore the drawing would be simplified and the coordinates of perspective views are more accurate.

When the formulas are programmed and the relevant data are fed into a computer, the corresponding points of perspective views will be obtained right away. On this basis, the whole perspective figure of the freeway will be drawn by the computer automatically.

The selection and plan of drawing sheets are also contained.

AUTHOR: YANG Peikun [2799 0160 2492]

ORG: Tongji University

TITLE: "An Analytical Method Based on Conflicts for Vehicular Capacity at Signalized Intersections"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 68-76

TEXT OF ENGLISH ABSTRACT: This paper presents a new analytical approach as a guide for calculating vehicular capacity at signalized intersections. The differences between this new method and the other methods employed at home and abroad are as follows: (1) the capacity calculated by this method is the capacity of vehicles passing through the conflicts at an intersection instead of the capacity of vehicles passing through the stop lines, and (2) the left-turn volumes are computed directly instead of using the equivalent factor. The movement state of the traffic through the conflicts at an intersection is described. The method of calculation and the formulae are provided with a typical example. All of the formulae have been reviewed practically.

AUTHOR: HU Yuren [5170 7183 0086]

ORG: Tongji University

TITLE: "Design of the Vibration Pick-up Model GCS-1 for Engineering Survey"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 77-88

TEXT OF ENGLISH ABSTRACT: In this paper, by using the method of transfer function analysis, an intact theoretical basis of vibrating displacement pick-up of pendulum type has been analyzed. The response of the pendulum system is also studied. A new type of element, a circular-tube shaped spring, has been adopted, thus simplifying the equipment structure and reducing the installed elements. In addition, a differential negative feedback circuit with compensative links is used, obviously improving the amplitude-phase characteristic of the system.

AUTHOR: SHEN Hongfu [3088 1347 3940]
ZHONG Weiling [6945 0251 7792]
WANG Jiazheng [3769 0502 2398]
WANG Hongxing [3769 3163 5281]

ORG: All of Tongji University

TITLE: "Development of a Differential Capacitance Accelerometer"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 89-97

TEXT OF ENGLISH ABSTRACT: The differential capacitance accelerometer has the following advantages: it can be used for measuring the acceleration of zero Hz; it can work under severe circumstances; it is small and light; its sensitivity is high and its follow-up apparatus required are simple. All these advantages make it a quite new accelerometer that has wide applications.

In this paper we have analyzed and discussed in detail its principles and the cause of its operation errors in order to offer a theoretical basis for developing this accelerometer. In addition, the practical functions of the developed accelerometer, Model CYJ-1, are also described.

AUTHOR: YANG Xizhang [2799 3356 4545]
WEI Daoduo [7614 6670 1000]

ORG: Both of Tongji University

TITLE: "Development of an Automatized Measuring Apparatus for the At-rest Earth Pressure Coefficient"

SOURCE: Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 98-103

TEXT OF ENGLISH ABSTRACT: The coefficient of at-rest earth pressure Ko is an important parameter in studies of deformation and strength properties of soils. In this paper, the development of a new Ko-meter as an innovation of the presently available laboratory apparatus by providing an automatized measuring and recording system is presented. Preliminary tests show that the instrument is simple in construction, easy to operate and the results are reliable. The automatized system may also be used with the triaxial apparatus. It is suggested that the new Ko-meter presented can be adopted for routine laboratory tests.

AUTHOR: LI Congxian [2621 1783 0341]
MIN Qiubao [7036 44231405]

ORG: Both of Tongji University

TITLE: "The Time of Holocene Transgression and Sea Level Changes in Apical Area of the Changjiang Delta"

SOURCEL Shanghai TONGJI DAXUE XUEBAO [JOURNAL OF TUNG-CHI UNIVERSITY] in Chinese No 3, 1981 pp 104-108

TEXT OF ENGLISH ABSTRACT: Based upon a investigation of the boring core in Zhenjiang, the apical area in the Changjiang Delta, the Holocene transgression is dated between 9000 and 6300 years BP, when sea level was located at 10-12 m and 2-3 m below the present Wusong level respectively. Since 6300 years BP in the area the Zhenjiang, boring deposited sediments of freshwater marsh, so it seems that in the Changjiang Delta area sea level was no higher then that at present during 5000-6000 years BP.

9717
CSO: 4009/58

Engineering Thermophysics

AUTHOR: YANG Donghua [2799 2639 5478]

ORG: East China Institute of Chemical Technology

TITLE: "Unified Expressions of Exergy and Anergy of Substance Systems"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 203-204

TEXT OF ENGLISH ABSTRACT: In this paper, unified expressions of exergy and anergy for three different kinds of substance systems, i.e., the closed system, the steady flow and the open system with steady flow, are given. According to given equations obtained from unified expressions, the product pv, based on its physical significance, can be considered as the work which is supplied from the upstream of a steady flow to downstream or an open system. The zero-exergy ex_0, which characterizes difference of composition between the steady flow and surrounding medium, is also involved. Accordingly, the unified expressions thus obtained are the most reasonable and generalized ones up to the present.

AUTHOR: LIU Dongbo [0491 2639 0514]

ORG: Huaibei Coal Teacher's College

TITLE: "An Investigation of the Thermodynamics of Irreversible Processes of Isothermal Elasto-plastic Metal"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 205-210

TEXT OF ENGLISH ABSTRACT: In view of the non-existence of mechanical state function for plasticity, it is attempted in this paper to investigate the thermodynamics of plasticity in terms of dislocational thermodynamic functions, such as:

$U = U(s.V.m.n)$..............internal energy
$s = s(T.V.m.n)$..............entropy
$F = (U - Ts) = F(T.V.m.n)$....free energy (Hemholtz)
$m + nn_0 =$ constant;
m, n and n_0--number of atoms in good region, of dislocations and of atoms per dislocation;
V--plastically incompressible volume of the metal. The results obtained are:

(1) dF_T is expressed in terms of entropy production ($d_i s > 0$) and in terms of dissipation ($\delta > 0$, $\Delta > 0$),

$dF_T = -\delta A - T d_i s = (-\delta A - \delta) < 0$........unloading
$dF_T = +\delta A - T d_i s = (+\delta A - \delta) > 0$........loading

[Continuation of GONGCHENG REWULI XUEBAO No 3, Aug 81 pp 205-210]

with:

$$\delta = T d_i s; \quad \Delta = \Delta_i s;$$

δA -- work of deformation.

(2) For thermodynamical stress-strain cycle (Th):

$$\oint_{Th} dF_T - \left[\oint_{Th} (\pm \delta A) - \Delta_{Th} \right] = 0;$$

(3) For non-thermodynamical stress-strain cycle (M):

$$\oint_M dF_T \neq 0 \cdots\cdots\cdots \text{non-thermodynamical cycle;}$$

$$\oint_M dF_T \nless 0 \cdots\cdots\cdots \text{perpetual free-energy-machine does not exist.}$$

therefore:

$$\oint_M dF_T - \left[\oint_M (\pm \delta A) - \Delta_M \right] > 0$$

Δ_M——total dissipation in the cycle.

(4) No matter whether the stress-strain cycle is thermodynamical or not, the cyclic work is always plastic and positive, and the absolute value of work is always greater in loading than in unloading. The only difference is that the plastic work is dissipated completely or partially.

[Continuation of GONGCHENG REWULI XUEBAO No 3, Aug 81 pp 205-210]

Inasmuch as the state function of elasticity cannot be extended to plasticity and the state function of this paper reflects the dislocational nature of plastic processes of metal, perhaps the theory of this paper may afford a thermodynamic foundation for plasticity.

AUTHOR: JU Zixiang [1446 3320 6272]
CHEN Yuanli [7115 0337 0448]
LIANG Cuifang [2733 5050 5364]
et al.

ORG: All of the Institute of Electrical Engineering, Chinese Academy of Sciences

TITLE: "Composition, Thermodynamic and Electrical Physical Properties of Seeded Coal Combustion Product"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 211-213

TEXT OF ENGLISH ABSTRACT: This paper describes briefly a method for calculating chemical composition in equilibrium, thermodynamic and electrical properties of seeded coal combustion plasma. Under conditions interested in MHD generation, 61 components in liquid and gas phase, 20 thermodynamic and 3 electrical properties are calculated respectively.

AUTHOR: WU Wen [0702 2429]

ORG: Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences

TITLE: "Technology of Utilization of Industrial Waste Heat"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 214-219

TEXT OF ENGLISH ABSTRACT: To utilize the industrial waste heat (IWH) is an effective way of promoting the total utilization of fuels. This paper first analyzes the forms and characteristics of IWH, then estimates its quantities and amounts of which can be utilized. After discussing three ways of utilization, i.e., electrical power generation, thermal utilization and their combination, various technical problems evolved are discussed in detail. These technical problems are new equipment, new technology and new processes. Finally, a recommendation is given that a financial appraisal be made to insure the benefit of adding and alternating of installations.

AUTHOR: LU Canren [0712 3605 0088]

ORG: Energy Sources Laboratory, Tianjin University

TITLE: "Thermodynamics Analyses of Binary Fluid Cycle with Low Enthalpy Energy Sources"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 220-223

TEXT OF ENGLISH ABSTRACT: This paper discusses the effects on energy conversion of binary fluid cycle with low temperature geothermal energy by means of availability function analysis of thermodynamics. An example is provided to show practice.

AUTHOR: None

ORG: Inlet Distortion Research Group, Northwestern Polytechnical University

TITLE: "An Investigation of the Characteristi and Instability Behavior of an Axial Compressor in a Turbojet Engine"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 224-229

TEXT OF ENGLISH ABSTRACT: In this paper, experimental results and analysis of the effect of the inlet pressure distortion, decrease in the first stage turbine nozzle area and engine test run program on the characteristic and instability behavior of an axial compressor in a turbojet engine are presented. The experiments have been conducted on the test bed of a turbojet engine with a nine-stage compressor, whose first stage is transonic.

The results show that: (1) inlet distortion and decrease in turbine nozzle area may shift considerably the speed lines of the compressor toward the left and cause it to become more flat; (2) the different run program for engine test may produce different speed line of compressor both in position and shape; (3) at low and medium speed, the instability of the compressor exhibits itself as a rotating stall, and at high speed a surge whose mode depends on the degree of inlet distortion and decrease in turbine nozzle area.

AUTHOR: LIU Zhiwei [0491 1807 0251]

ORG: Northwestern Polytechnical University

TITLE: "Prediction of Onset of Rotating Stall Using Small Perturbation Theory for Axial Flow Compressors"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 230-236

TEXT OF ENGLISH ABSTRACT: This paper analyzes, generalizes and compares different onset conditions of the predicting rotating stall, which are based on the small perturbation theory. They are correlated to experimental data of rotors for single stage axial flow compressors. Good agreement between theoretical values and experimental values is found. Mechanism for the onset condition of the rotating stall is analyzed. Effectiveness of methods of prediction is proved. The extent of application of methods is extended.

AUTHOR: ZHANG Yujing [1728 3768 3878]

ORG: Harbin Marine Boiler and Turbine Research Institute

TITLE: "Some Considerations Concerning the Principal Equation for the Aerodynamic Calculation of Non-radial Calculation Station on S_2 Stream-surface Flow in Turbomachines"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 237-242

TEXT OF ENGLISH ABSTRACT: Based on Wu's equations expressed in terms of non-orthogonal curvilinear coordinates, this paper derives a y-direction equation of motion for the aerodynamic calculation of the non-radial calculation station on the S_2 stream-surface flow in a turbomachine blade passage. Thereby it is proved that the equation applied by Hetherington (1974) is correct. By means of transformation, it is pointed out that the principal equation of this paper is in full agreement with that presented by Hong previously.

AUTHOR: GAO Lijun [7559 7787 0689]
WU Wendong [0702 2429 2639]
WANG Yingshi [3769 2019 2514]

ORG: All of the Institute of Engineering Thermophysics, Chinese Academy of Sciences

TITLE: "Numerical Calculation of a Subsonic Compressible Turbulent Flow in a Conical Diffuser"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 243-249

TEXT OF ENGLISH ABSTRACT: In this paper, vorticity ω and stream function Ψ are used as dependent variables to predict the turbulent flow. Generally, the method can be used to calculate both recirculating flow and non-recirculating flow. The calculation of the turbulent flow in a conical diffuser having a total divergence angle of 10°, and with nonuniform velocity distribution at entry, is carried out. Because the flow relates only to the developing process of turbulence boundary layer, Prandte mixing length hypothesis is used in this calculation.

The numerical results agree with the experimental data quite well. They show that this method can be applied to the design of a diffuser without recirculating flow.

AUTHOR: WANG Jiasheng [3769 3946 0581]

ORG: Shanghai Institute of Mechanical Engineering

TITLE: "The Analysis of Forces and Powers in Turbomachinery Gas Dynamics"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 250-252

TEXT OF ENGLISH ABSTRACT: Correctly analyzing the forces and powers is a very important problem in turbomachinery gas dynamics. This problem is discussed in detail in this paper, and it is concluded that the realization of forces and powers is concerned with the situation of observers. When we discuss the forces, we must point out the situation of observers; when we discuss the powers, we must point out what force to work in what motion.

AUTHOR: ZHU Rongguo [2612 2837 0948]

ORG: Institute of Engineering Thermophysics, Chinese Academy of Sciences

TITLE: "Flow-field Line Relaxation Solution for S_2 Relative Stream Surface with the Splitter Boundary Condition"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 253-255

TEXT OF ENGLISH ABSTRACT: Based on Wu's general three-dimensional turbomachine flow theory, a computer program of flow field matrix line relaxation was established for flow along the relative stream surface S_2 of ducted fans in the bypass engine.

The development of that considered in a previous article by the author and the splitter boundary condition of the fan compressor was considered, resulting in the improvement of the structure of the computer program.

AUTHOR: LI Keming [2621 0344 2494]
ZHAO Quanchun [6392 0356 2504]
SUN Yuanying [1327 0337 2819]

ORG: All of Shenyang Aeroengine Research Institute

TITLE: "Effect of Casing Treatment on Performance of an Axial Compressor"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 256-258

TEXT OF ENGLISH ABSTRACT: An experimental investigation was conducted, that is reported in this paper, to obtain the effectiveness of four treated casing configurations on performance of an axial compressor. Tests show that the surge margin and distortion tolerance for the axial compressor are improved by means of casing treatment, so that the circumferential pressure profile is further improved and the peak efficiency of the compressor is almost unaffected. There is a common trend for the four treated casings, i.e., the increment in surge margin at lower speed is greater than that at higher speed; the increment in surge margin with distorted inlet flow is more than that with uniform inlet flow.

AUTHOR: TIAN Minhua [3944 2404 5478]

ORG: None

TITLE: "A Calculation Method for the Rocket Engine's Optimum Thrust Nozzle Contour Design"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 259-261

TEXT OF ENGLISH ABSTRACT: Combining the characteristic method with variation principle and applying it to supersonic flow field, a calculating method is presented for the optimum-thrust-nozzle contour design. This method can be used to design nozzle contours with various throat curvature radii and expansion area ratios. It is especially suitable for the design of nozzle contour with large expansion area ratio.

AUTHOR: WANG Buxuan [3769 5943 1357]
REN Zepei [0117 3419 7198]

ORG: Both of Qinghua University

TITLE: "Research of the Application of Twin-plate Device for Measurement of the Thermal Conductivity to Determine the Thermal Diffusivity of Insulating Materials"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 262-268

TEXT OF ENGLISH ABSTRACT: In this paper, a theoretical analysis of the transient process after change of heating rate in a twin-plate device for measurement of thermal conductivity is reported. The influence of heat capacity of the electric heater on the transient temperature distribution in the test plate is discussed. Based on these analyses, a method for determination of the thermal diffusivity of insulating materials with the twin-plate device is proposed.

AUTHOR: MA Tongze [7456 0681 3419]
ZHANG Baodong [1728 0202 2767]
AN Zhiqing [1344 1807 3237]
et al.

ORG: All of the Institute of Engineering Thermophysics, Chinese Academy of Sciences

TITLE: "Heat Transfer and Friction for Turbulent Flow in Annuli with Repeated-Rib Roughness"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 269-275

TEXT OF ENGLISH ABSTRACT: Experimental investigation for heat transfer and friction coefficients has been performed for repeated-rib roughness in an annular turbulent air flow in which the inner surface is rough and the outer surface is smooth. The sectional shape of the ribs is trapezoidal. The relative rib spacing s/h varies in the range of 8-17 and the Reynolds number in the range of $1 \times 10^4 - 1.5 \times 10^5$. The correlations for heat transfer and friction have been developed. The film heat transfer coefficients for rough annuli are 1.5 - 2.1 times those of smooth annuli. The thermal performance has been analyzed.

AUTHOR: FENG Zuyi [7458 4371 3976]
SHANG Shanzui [0794 0810 2584]
et al.

ORG: FENG of the Shanghai Light Industry Design Institute; SHANG of the Shanghai Ship Research Institute; et al.

TITLE: "Preliminary Tests on Coal-Oil Mixture and Its Mechanism Studies"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 276-279

TEXT OF ENGLISH ABSTRACT: This paper merely presents a general picture covering mechanical propeller stirring apparatus, liquid whistles, piezo-electric transducers to prepare COM and use of an ultrasonic atomizer for combustion tests and its preliminary mechanism studies. Our main purposes in researching and developing COM fuels are as follows: (1) Saving liquid petroleum-fossil fuel consumption, (2) broadening the scope of use of different kinds of coal, and (3) utilizing COM as fuel for existing oil-burning boilers, industrial furnaces, etc., with minor modifications before coal gasification or coal liquefaction technique becomes commercially practicable.

AUTHOR: ZHU Changqing [2612 7022 7230]

ORG: Northwestern Polytechnical University

TITLE: "Calculation for the Wall Temperature of Turbo-jet Flame Tubes"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 280-282

TEXT OF ENGLISH ABSTRACT: This paper prepares a method for calculating the wall temperature of turbo-jet flame tubes and prepares a simple method for calculating the wall temperature profile of flame tubes.

AUTHOR: HE Guanhu [0149 0385 5706]
YE Qinghe [5509 1987 0735]
DI Zhongqi [6732 1813 6386]
et al.

ORG: All of the Institute of Metal Research, Chinese Academy of Sciences

TITLE: "The Measurement of Specific Heat by Laser Pulse Heating-Cooling Method (500-1200 K)"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 283-289

TEXT OF ENGLISH ABSTRACT: A new method of measuring specific heat, i.e., laser pulse heating-cooling method, is described in respect to its principle, experimental equipment and specimen preparation. The relationship between C_p/ε_n (C_p--specific heat, ε_n--effective emissivity) and temperature (500-1200 K) has been measured with pure iron as a standard material, and thus the value of ε_n may be obtained. The average square root deviation of the experimental value of C_p/ε_n is ±3.3 percent. The specific heat of pure copper was measured by this method and compared with that reported in the literature.

AUTHOR: TAN Zhicheng [6223 1807 6134]
ZHOU Lixing [0719 4539 1630]
YIN Anxue [1438 1344 1331]
et al.

ORG: All of Dalian Institute of Chemical Physics, Chinese Academy of Sciences

TITLE: "An Automatic Adiabatic Calorimeter from 80 to 400 K and Heat Capacity Measurements of Complex Thermal Control Materials for Spacecraft"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 290-297

TEXT OF ENGLISH ABSTRACT: A precision adiabatic calorimeter for heat-capacity measurements of solids and liquids from 80 to 400 K has been constructed. The sample container of the calorimeter is made of pure silver, 0.3 mm thick gold-plated and polished, with a volume of about 40 ml and a total weight of about 50 g.

The temperature and electric energy supplied are separately measured by two sets of precision potentiometers. The heating interval is controlled and measured automatically with an electronic timer. The control of adiabatic condition is carried out automatically by the Model DWT-702 precision temperature controller. The temperature difference between the thermal shield and the sample container could be kept within ± 0.001 K.

[Continuation of GONGCHENG REWULI XUEBAO No 3, Aug 81 pp 290-297]

The measurements of heat capacity of α-Al_2O_3 (purity 99.993 percent) prove the precision to be ± 0.04 percent and give an accuracy of ± 0.2 percent. With this calorimeter we have measured the heat capacities of 11 complex thermal control coatings, thermo-insulation and ablative materials for spacecrafts. All the figures and tables of the data are given and a formula for estimating error has been derived in this paper.

AUTHOR: ZHAO Lan
et al.

ORG: None

TITLE: "An Apparatus for Measurement of Mean Specific Heat at High Temperatures"

SOURCE: Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese No 3, Aug 81 pp 298-300

TEXT OF ENGLISH ABSTRACT: **A description is given of an apparatus used for determining the mean specific heat of solids in the temperature range of 800-2600°C. The specific heat of graphite, carbon, Nb Alloy D-43 and N_b-752 were measured with this apparatus and the relative error is less than ± 3 percent.**

9717
CSO: 4009/59

Mechanics

AUTHOR: HUANG Kezhi [7806 0344 2535]
ZHENG Zhaochang [6774 0340 2490]

ORG: Both of Qinghua University

TITLE: "General Instability of Ring-stiffened Cylindrical Shells Subject to Hydrostatic Pressure"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 271-286

TEXT OF ENGLISH ABSTRACT: This paper presents a method for calculating the buckling load and mode shape of a ring-stiffened circular cylindrical shell subject to hydrostatic pressure. According to the composite structure method, a set of differential equations for the stability of rings and interring shell segments is established separately. With the height of the ring cross section, eccentric distance, sum of cross sectional area ΣF_{λ} and sum of bending rigidity $\Sigma E_{\lambda} I_{G\lambda a}$ kept constant, the number of rings is assumed to tend to infinity, and an equivalent orthotropic shell with appropriate elastic constants is obtained as a zero-order approximation. In addition, we can seek for the solution of equations for the ring-stiffened shell in the form of a series. The first term of the series corresponds to the zero-order approximation, i.e., the solution of the above-mentioned equivalent orthotropic shell. The remaining terms represent the correction of various orders,

[Continuation of GUTI LIXUE XUEBAO No 3, Aug 81 pp 271-286]

which may serve as an indication of the error arising from substituting the real ring-stiffened shell with the equivalent orthotropic one. Finally an example is given and a comparison is made between our results and those by other authors' methods. Our theoretical results indicate a good agreement with the experimental data.

AUTHOR: FAN Fuqun [5400 6346 5028]

ORG: South China Polytechnical Institute

TITLE: "The Load Concentration Factor and the Statistic Theory of Crack Propagation of a Unidirectionally Fiber-reinforced Composite"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 287-295

TEXT OF ENGLISH ABSTRACT: This paper discusses two principal viewpoints concerning the statistic theory of crack propagation of a unidirectionally fiber-reinforced composite. One is the calculation of stress redistribution due to sequential fiber breaking. By using the model common in shear-lag investigations, both the plastic analysis by the deformation theory and the elastic analysis are made. The results of the elastic analysis agree with those obtained by J. M. Hedgepeth. Also, studies are made on the development of a crack propagation model. The Gucer-Gurland-Rosen Chain Model is abandoned while a model of gradually enlarging crack layer is presented. Then, through performing a statistic analysis by referring to the method used by A. S. Argon, et al., a formula for calculating the tensile strength of a unidirectionally fiber-reinforced composite is obtained.

AUTHOR: WU Wenzhou [0702 2429 0719]
SUN Jue [1327 3778]

ORG: Both of Taiyuan Polytechnical Institute

TITLE: "An Analysis of the Stress Field of the Human Knee Joint"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 296-301

TEXT OF ENGLISH ABSTRACT: In this paper, a two-dimensional built-up structure model consisting of plates of different material constants is developed for the human knee. The finite element method is adopted to analyze the stress field. The results obtained are: a) for the tibial plateau, both the maximum compressive and maximum shear stress are on the lateral plateau; b) the surface load on the subchondral bone of the femur is transmitted almost directly to the subchondral tibial bone; c) the stress distribution in the articular cartilage is uniform; d) the effect of the lubricant liquid is not taken into account, but the results obtained show that there is practically no shear stress on the tibio-femoral contact surface.

AUTHOR: LU Zhongming [7120 1813 2494]

ORG: Shanghai Power Plant Equipment Research Institute

TITLE: "Determination of the Flexural Center of Blade Profiles by Non-orthogonal Coordinate Difference Method"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 302-311

TEXT OF ENGLISH ABSTRACT: The flexural center of sections with complex curved boundaries like those of blade profiles is calculated by obtaining solutions for stress functions and warping functions with a non-orthogonal coordinate difference method.

To determine the flexural center, a number of lattices that approach in shape the given boundaries should first be chosen and an appropriate non-orthogonal coordinate system taken. Then, after difference schemes are derived with the help of loop integrals in the mesh region, solutions are found by a direct method for sets of the symmetric bond type linear algebraic equations obtained, and Romberg's formula is used to numerically integrate the functional values of the mesh points. In conclusion, to demonstrate the precision of the proposed method, some elliptic and semicircular sections are treated and the calculated values satisfactorily approach those of exact solutions.

AUTHOR: FANG Tong [2455 0681]

ORG: Northwestern Polytechnical Institute

TITLE: "Modal Analysis for Linear Damped Systems with Many Degrees of Freedom"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 312-316

TEXT OF ENGLISH ABSTRACT: In this article, discrete linear nonconservative systems with unsymmetrical matrices are considered. By making use of the properties of the adjoining matrices, the complex modal expansion formula for the transfer function matrix has been derived with ease.

AUTHOR: ZHANG Wen [1728 2429]

ORG: Fudan University

TITLE: "Linearization of the Impact of Elastic Systems"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 317-325

TEXT OF ENGLISH ABSTRACT: The impact of elastic systems is a complicated nonlinear phenomenon. By an analysis of the fundamental central impact of two elastic solids, we have demonstrated that this nonlinear impact phenomenon may be linearized, qualitatively and quantitatively, with an equivalent spring and an equivalent initial velocity. Thus, the impact problem of elastic systems may be reduced to an appropriate free vibration initial value problem for a linearized system, for which the general solutions are deduced in this paper. Numerical examples show that the method proposed is both simple and efficient.

AUTHOR: CHEN Wanji [7115 8001 0679]

ORG: Engineering Mechanics Research Center, Polytechnic Institute of Dalian

TITLE: "An Analysis of Coupled Thermal-elastic Contact Problems with the Finite Element Method"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 326-336

TEXT OF ENGLISH ABSTRACT: In the analysis of thermal load in heated elastic bodies contacting each other, it is necessary to consider the complex contact heat conducting condition as well as the elastic contact condition in addition to taking into account the coupling effect.

A very effective approach, the mixed finite element method, is proposed in this work. The calculated results show that in solving such a class of problems with complex nonlinear boundary conditions by this method, the calculating and storing time is slightly longer than or equal to that when solving thermal load problems of general linear continuous bodies.

AUTHOR: LIU Yanzhu [0491 1693 2691]

ORG: Shanghai Jiaotong University

TITLE: "Nutational Motion of Dynamically Tuned Gyroscope"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 337-342

TEXT OF ENGLISH ABSTRACT: The dynamically tuned gyroscope is a system of rigid bodies restrained by elastic torsional elements, the torsional moments of which are being compensated for by the dynamically tuning effect. The nutational motion of the gyroscope is discussed by an asymptotic method containing two time scales. The criterion of stability is given and the nutation-drift phenomenon as well as its influence on the tuning condition is treated.

AUTHOR: WANG Dajun [3769 1129 6874]
REN Junguo [0117 6874 0948]
CHEN Ping [7115 1627]

ORG: All of Beijing University

TITLE: "Vibration Analysis of Shells of Revolution by the Modal Synthesis Method"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 343-351

TEXT OF ENGLISH ABSTRACT: This paper suggests a modal synthesis method for calculating natural vibration and seismic response for a shell of revolution. The procedure is based on an earlier work. The generator of the shell may be of any form, even one consisting of piecewise curves, but the stiffness and mass matrices of the shell still keep the quasi-diagonal advantage.

The paper presents a computer program by the authors and a numerical example illustrating the effectiveness of this method.

AUTHOR: WANG Jizhong [3769 1323 0022]
ZHANG Wenzhi [1728 2429 0037]

ORG: Both of Shandong Engineering Institute

TITLE: "Separation of the Absolute Retardation Fringes by Using Polarizing Holography"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 352-357

TEXT OF ENGLISH ABSTRACT: A new method for separating the absolute retardation fringes by using polarizing holography is presented. With this method, Nisida's pattern and the two-family absolute retardation fringes can be directly observed through a single double-exposure hologram. If a linear polarizer is placed between the hologram and the observer while the polarizer is being rotated, the absolute retardation fringes on those points where the transmission axis of the polarizer is parallel to a principal stress can also be observed, so the two-family absolute retardation fringes can be separated accurately in the whole model.

The general expression for the light intensity of the reconstructed virtual image through the polarizer is derived by using the Jones vector and matrix calculus. Finally experimental results are presented.

AUTHOR: HUANG Yuying [7806 3768 4134]
JIN Mengshi [6855 1125 4258]
LEI Guopu [7191 0948 3877]

ORG: All of Wuhan Huazhong Institute of Technology

TITLE: "The Theory of Post-buckling of Structures and Its Prospects"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 397-408

TEXT OF ENGLISH ABSTRACT: In the last 10 years and more, the general theory and application of elastic post-buckling have been advancing fairly rapidly. Since it has solved many an important problem never before solved by any classical theory of buckling, people in various circles (mechanics, structure and mathematics) are attaching ever-increasing importance to it. Harvard University and the University College of London have both set up research groups working on this topic. This paper describes the historical background against which the post-buckling theory has been developed, its analytical methods and the prospects for the theory.

AUTHOR: WANG Zhenming [3769 7201 7686]

ORG: Institute of Mechanics, Chinese Academy of Sciences

TITLE: "The Calculation of a Composite Cylindrical Shell of Steel and Concrete"

SOURCE: Wuhan GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 3, Aug 81 pp 409-420

TEXT OF ENGLISH ABSTRACT: In this paper, we used a composite cylindrical shell of steel and concrete for large floating cover oil tank to investigate the stress analysis problem of a bilayer cylindrical shell under the action of liquid pressure, temperature difference and the contraction of concrete. An example of calculation of an oil tank of 2 x $10^5 M^3$ is given to illustrate the advantages of this composite structure.

9717
CSO: 4009/52

AUTHOR: LIAO Pinjun [1675 0756 6874]

ORG: Department of Mining and Mineral Engineering

TITLE: "An Electrochemical Study of the Oxidation of Violarite Surface and the Interaction of Violarite Surface with the Reagents"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 1-8

TEXT OF ENGLISH ABSTRACT: In this paper, triangular potential sweep and Eh-pH diagram are used to study the conditions of oxidation and stability of violarite surface, the mechanism in the interaction of potassium ethyl xanthate (KEtX) on violarite electrode and the effect of Mg^{2+} or magnesite slime on the reaction of KEtX on violarite surface. The results obtained can be regarded as the fundamental data for flotation research of such nickel sulfide ores.

AUTHOR: CHEN Wanxiong [7115 8001 7160]
CHEN Jin [7115 5660]
YU Xuehua [0151 7185 5363]
et al.

ORG: All of the Department of Mining and Mineral Engineering

TITLE: "A Study of the Reaction Order of Flotation Rate"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 9-18

TEXT OF ENGLISH ABSTRACT: In the flotation rate equation $\frac{d\varepsilon}{dt} = K(\varepsilon_\infty - \varepsilon)^n$, the "n" value of flotation rate equation was determined experimentally. Flotation tests were run in a modified Hollimond tube over hematite materials of various size fractions. Respective reaction orders were obtained.

If K_I is expressed as the first order rate constant of tested materials, as $K_{I_{max}} - K_{I_{min}} > 1.5$, the flotation rate equation of the material composed of different K_I values correlates with the second order reaction, regardless of the continuity of K_I (continuous or discontinuous); when $K_{I_{max}} - K_{I_{min}} < 0.5$, the flotation rate equation fits first order reactions. As $1.5 > K_{I_{max}} - K_{I_{min}} > 0.5$, the reaction order lies between 1 and 2, i.e., in a nonintegral order.

[Continuation of ZHONGNAN KUANGYE XUEYUAN XUEBAO No 2, Jun 81 pp 9-18]

Reaction orders of the materials composed of various K_I values were summarized in the following table.

Reaction Orders of Materials Composed of Various K_I Values

Size Composition (μ)	Continuity of K_I Value	$K_{I_{max}} - K_{I_{min}}$ (or ΔK_I)	Reaction Order (n)	Notes
I. −100 +10	cont.	3.2 (3.0)	2	Fig.3
II. −20 +10 −100 +76	discont.	3.2 (3.0)	2	Fig.3
III. −76 +10	cont.	3.0 (2.0)	2	Fig.3
IV. −45 +10	cont.	1.5 (1.0)	2	Fig.3
V. −76 +45	cont.	1.2	1—2	Fig.8
VI. −100 +76	cont.	1.0	1—2	Fig.9
VII. −30 +10	cont.	0.7 (0.3)	1—2	Fig.6
VIII. −45 +30	cont.	0.6	1—2	Fig.7
IX. −30 +20	cont.	0.5	1	Fig.1
X. −20 +10	cont.	0.4	1	Fig.1
XI. −200 +150	cont.	0.3	1	Fig.1
XII. −250 +200	cont.	0.1	1	Fig.1

[Continuation of ZHONGNAN KUANGYE XUEYUAN XUEBAO No 2, Jun 81 pp 9-18]

Hence, the "n" value of flotation rate equation ought to be 1, 2 and 1-2, a non-integral order.

AUTHOR: WANG Changhan [3769 2490 3352]

ORG: Department of Mining and Mineral Engineering

TITLE: "The Study of Several Problems in Ore Drawing with the Theory of the Plastic-stress Limit Equilibrium"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 19-28

TEXT OF ENGLISH ABSTRACT: By the use of the theory of limit equilibrium under the action of plastic-stress, the fundamental law of the movement of broken grounds under drawing and their moving limit have been analyzed and the new viewpoint about the equivalent drawing ellipsoid is pointed out in this paper. Based on granular mechanics, the method of calculating the reasonable structural parameters of the slopes has been carried out and the sublevel caving has also been stated.

AUTHOR: HE Jishan [0149 4949 0810]
BAO Guangshu [7637 0342 3219]

ORG: Both of the Department of Geology

TITLE: "On Current Waveforms Used in Dual Frequency Channel IP Method"

SOURCEL Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 29-37

TEXT OF ENGLISH ABSTRACT: In developing the dual-frequency (DF) channel IP method, we have designed and made a new kind of equipment. The tranumitter is operated at two frequencies simultaneously. PFE is automatically calculated and displayed by liquid crystal in dual channel receiver. During the past few years, a number of sets of this equipment were being used in various areas. In this paper, the general form and behavior of DF current are discussed. The DF current can be superposed by two square waveform currents which, however, must be coherent, otherwise false PFE occurs. The ability of various shapes of DF currents to build up polarization is the same. The effect of current unsteadiness on PFE measured with DF channel IP method is much slighter than that measured with customary variable frequency IP method. In fact, it is not necessary to maintain constant current when DF channel IP method is employed.

AUTHOR: CHEN Jida [7115 7139 6671]

ORG: Department of Automation

TITLE: "The State Observer for DC Motor Speed Control Systems with SCR"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 38-47

TEXT OF ENGLISH ABSTRACT: In this paper, the problem is described of a controlled plant identity observer being designed based on the state observer theory presented by D.G. Luenberger. By means of the observer the low noise motor armature current and speed estimation signal may be obtained to realize closed-loop control. Therefore, the current and speed adjuster will be able to be free from the noise disturbance. Also, the filter in the feedback path is not needed. A proper derivative feedback may be introduced into the system to obtain a higher performance index.

AUTHOR: HUANG Zhenqian [7806 2182 6197]

ORG: Department of Chemistry

TITLE: "Potential-pH Diagram for Chalcopyrite-Water System at 25°C"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 48-54, 85

TEXT OF ENGLISH ABSTRACT: The basic principle of making the potential-pH diagram has been elucidated in this paper. The potential-pH diatrams for chalcopyrite-water system at 25°C are also constructed.

AUTHOR: WANG Manxing [3769 2581 2502]
SONG Jisheng [1345 0370 3932]

ORG: Both of the Department of Metal Materials

TITLE: "A Study of the Minimum Reducible Thickness"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 55-62

TEXT OF ENGLISH ABSTRACT: In this paper it is considered that the study of the minimum reducible thickness of a thin sheet should be connected with the rolling conditions and there is presented a mathematical model of the minimum reducible thickness under the multitude-pass rolling condition. It is also found by experiment that there exists a superior zone under the influence at the front end of the workpiece and the authors have made a preliminary analysis of the reason producing such a zone.

AUTHOR: LI Yizhi [2621 0001 2535]

ORG: Department of Mining and Mineral Engineering

TITLE: "Loop Method on Computer in Mine Ventilation Planning"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 63-68

TEXT OF ENGLISH ABSTRACT: In mine ventilation planning, the required total airflow and air quantities of some splits should be calculated in advance and then be fixed; the air quantities flowing in other splits can be distributed naturally. In this manner, the air quantities of all branches, the regulating resistances of the fixed flow branches and the total pressure requirements will be calculated, and then the main fans will be selected reasonably. In this paper the application of graph theory will present the Linearization-Iteration Loop Method for mine ventilation planning. Air quantities of all the free-flow branches will be computed with the mesh-flow solved iteratively and the fundamental-circuits (meshes) matrix, which are not estimated conventionally through experience, and hence this method will give the most economical and reasonable total pressure requirements. The regulating resistances of the fixed-flow branches will then be calculated if these branches exist in the network. For the selection of the main fans, some formulae are given for calculating the reasonable diameter of the rotor $D = C\sqrt{A_f}$, with A_f--equivalent orifice and C--statistical factor obtained currently according

[Continuation of ZHONGNAN KUANGYE XUEYUAN XUEBAO No 2, Jun 81 pp 63-68]

to the type of the fan. For planning on a computer, the source program with ALGOL has been designed, and an example is given.

AUTHOR: PENG Mingsheng [1756 2494 3932]

ORG: Department of Geology

TITLE: "Calculation of Standard Entropy Value of Oxyacid Salt Minerals"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 69-78

TEXT OF ENGLISH ABSTRACT: Any oxyacid salt minerals can be considered as results of reaction on a single substance composition. Their standard reaction entropy $\Delta S^0{}_R$ with the standard entropy $S^0{}_f$ of a single substance composition has the following relationship:

$$\Delta S^0{}_R = S^0{}_{fA.B} - (S^0{}_{fA} + S^0{}_{fB})$$

We made a series of statistics on standard reaction entropy $\Delta S^0{}_R$ among the bulk volume of oxyacid salt compounds and studied the relationship between them. We discovered that they exhibit an approximative straight line. Applying this relationship we obtained $\Delta S^0{}_R$, $S^0{}_{fA+B}$ as the known value, and thus the standard entropy $S^0{}_f$ of oxyacid salt minerals can be calculated according to the following formulas:

$$-\Delta S^0{}_R = a \cdot f + b$$

$$-\Delta S^0{}_R = K(a \cdot f + b)$$

[Continuation of ZHONGNAN KUANGYE XUEYUAN XUEBAO No 2, Jun 81 pp 69-78]

$$S^0_{fAB} = \frac{\Sigma S^0_{fA+B} + \Delta S^0_R}{K}$$

In the above formulas, the coefficients of a, b, k, f, etc., can be ascertained by calculation.

Simple silicate minerals could be considered as synthesized results of oxides, therefore we may obtain the following approximative calculation formula:

$$S^0_{fMSiO_3 \text{ or } MSiO_4} \simeq \Sigma S^0_{f(oxides)}$$

AUTHOR: SHI Zhiyi [4258 1807 0308]
ZHOU Qiumin [0719 4423 2404]

ORG: Both of the Department of Metal Materials

TITLE: "The Calculation of the Liquidus Isotherms in Ga-As-Te System"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 79-85

TEXT OF ENGLISH ABSTRACT: The liquidus isotherms in Ga-As-Te system at 900, 1000, 1150 and 1200°C are calculated according to the quasi-regular solution model by using 21 ternary and 14 binary published experimental data. The agreement of the calculated phase diagram with experimental data is satisfactory. It was attempted to describe the Ga-Te, As-Te interaction parameters as $a+bT+cT^2$ based on the simple solution model, but the calculated results did not improve their agreement with the experimental data, so the quasi-regular solution could be considered applicable to the Ga-As-Te system.

AUTHOR: CHEN Gongwen [7115 6300 2429]
TAN Shuxiang [6223 2579 7449]
SUN Yiping [1327 0001 1627]

ORG: All of the Institute's Analytical Laboratory

TITLE: "A New Type of High Precision Electromagnetic Valve Suitable for Automatic Chemical Analysis"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 86-92

TEXT OF ENGLISH ABSTRACT: A high precision electromagnetic valve consisting of the new valve body has been designed. It is suitable for automatic titration of constant flow-time measuring method as well as general automatic chemical analyzers. Using the oscilloscope and calibration tube method designed by the authors, a comparison was made of the characteristics of different electromagnetic valves and the precision of switches, thereby proving that the new type of electromagnetic valve has a good switch reproducibility (at 6 ml/min flow rate, the relative standard deviation measured with 130 μl calibration tube is <0.1 percent, equivalent to 0.13 μl), and high long-term repetition (after switching 1 million times continuously under 2 meter column pressure, there is no leakage within 24 hours and the precision of the switch generally remains unchanged). When the electromagnetic coil is put in parallel with suitable resistance-capacitance delay time

[Continuation of ZHONGNAN KUANGYE XUEYUAN XUEBAO No 2, Jun 81 pp 86-92]

circuit, it makes the flowing volume proportional to the time passing the electric current through the electromagnetic valve. The valve can fundamentally improve the reliability of constant flow-time measuring method and greatly increase the precision of the measurement. Being used in other automatic chemical analyzers, it will improve their performance.

AUTHOR: ZHANG Housu [1728 0796 5685]

ORG: Department of Mining and Mineral Engineering

TITLE: "A Comparison between Two Methods of Calculation of Weights in Triangular Network of Measured Angles and Sides"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 93-96

TEXT OF ENGLISH ABSTRACT: There are two kinds of views concerning the ratio of weights of measured sides and angles in the adjustment of a triangular network of measured sides and angles:

1. $P_\alpha = \frac{c}{m_\alpha^2}$ $\qquad$ $P_S = \frac{c}{m_S^2}$

2. $P_\alpha = \frac{c}{m_\alpha^2} \left(\frac{\rho}{S}\right)^2$ $\qquad$ $P_S = \frac{c}{m_S^2}$

This paper has proved by means of modelling in the computer that the first plan of calculation of the weights is reasonable.

AUTHOR: ZHANG Rubai [1728 1172 2672]

ORG: Chengdu Geological College

TITLE: "The Discovery of Cookeite in Altai Pegmatite"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 97-101

TEXT OF ENGLISH ABSTRACT: Cookeite is a lithium aluminum silicate mineral, a replacement product of amblygonite, spodumen, petalite, elbaite, etc., occurring in rich-Li pegmatite. So far, a report of this mineral has not yet been made in China.

In this paper it is reported that cookeite has been found in the Altai pegmatite. It is pink or purple in color. It is grainy and has massive colonies, white streaks and glassy luster. Moh's number of 2.0 - 2.5, specific gravity is 2.58 (specific gravity bottle).

Under the polarizing microscope it is transparent and colorless. The pleochroic formula of cookeite is Ng = pinkish, Np = Nm = colorless. Absorption formula is Ng > Nm (Np). The mineral is biaxial-crystal positive with Ng = 1.585, Np = 1.575, Nm = 1.580, Ng-Np = 0.01, 2V = 77-83° (calc).

[Continuation of ZHONGNAN KUANGYE XUEYUAN XUEBAO No 2, Jun 81 pp 97-101]

The chemical composition of cookeite is SiO_2 33.10, Al_2O_3 35.38, CaO 5.07, P_2O_5 4.97, Li_2O 3.80, MgO 1.83, Na_2O 0.78, K_2O 1.50, FeO 0.40, H_2O^+ 12.83, H_2O^- 0.05, total 99.71. According to the calculation of the chemical composition, the crystal-chemical formula of cookeite is $(Li_{2.74}\ Mg_{0.49}\ Ca_{0.99}\ Na_{0.27}\ K_{0.34}\ Fe^{2+}_{0.05}\ Al_{6.21})_{11.09}\ (Si_{5.96}\ Al_{1.30}\ P_{0.74})_8\ O_{20}\ (OH)_{15.50}$.

The strongest X-ray powder lines are 6.977(4,002); 4.678(7,003); 4.458(5,020); 3.516(9,004); 2.805(5,005); 2.331(10,006); 1.630(5,240); 1.485(9,060,138). The unit-cell parameters are $a = 5.12$ A, $b = 8.85$ A, $c = 14.14$ A, $\beta = 97°$.

In the paper curves of DTA, infrared spectra of cookeite are also presented.

AUTHOR: HU Zhaohuang [5170 2507 3552]

ORG: Department of Basic Courses

TITLE: "The Extension and Application of Ampere's Law"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 102-106

TEXT OF ENGLISH ABSTRACT: The article introduces a general formula which expresses the relationship between the closed line integral of the magnetic field and the conduction current. The formula can be considered as the extension of Ampere's Law. The association of the closed line integral of the magnetic field with the solid angle is the characteristic of the formula. Through actual examples the article illustrates how to use the solid angle for calculating the magnetic field.

AUTHOR: HE Luqing [0149 4389 0615]
DIAO Peiliang [0431 1014 5328]

ORG: Both of the Institute's Analytical Laboratory

TITLE: "A Study of Reliability of Gases Extracted from Inclusion in Minerals by Heating Decrepitation Method"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 107-113

TEXT OF ENGLISH ABSTRACT: In order to improve on the reliability of gases in mineral inclusions being extracted by the heating decrepitation method, the specific effects of extracting temperature on dynamic characteristics of water, carbon dioxide, nitrogen, hydrogen and methane evacuated from inclusions in minerals are investigated in this paper. In addition, chemical reactions between gas and gas as well as gas and solid are also studied through tests of the gaseous mixture.

The investigations of dynamics and thermodynamics show that the gas phase of inclusions is examined in quartz from gold veins which consists mainly of N_2, H_2O and CO_2. However, a considerable part of H_2 and CH_4 found by heating decrepitation method is probably due to chemical reactions and the decomposition of organic matter. In accordance with the calculation of chemical thermodynamics, it is possible that chemical reactions, such as $CO+H_2O \rightleftarrows CO_2+H_2$, $CH_4+H_2O \rightleftarrows CO+3H_2$ and

[Continuation of ZHONGNAN KUANGYE XUEYUAN XUEBAO No 2, Jun 81 pp 107-113]

$2FeO+H_2O \rightleftarrows Fe_2O_3+H_2$ can take place under the circumstances of the heating decrepitation method. It is demonstrated that the chemical reactions depend on extracting temperature, concentration of gases and presence of water.

The authors have designed a vacuum extraction device for heating decrepitation method. It can prevent chemical reactions. It is possible to extract gases in mineral inclusions reliably.

AUTHOR: DING Biying [0002 4310 5391]
YANG Yanzheng [2799 3601 1767]
LIAO Fengxian [1675 7685 0341]

ORG: All of the Department of Geology

TITLE: "The Fluid Inclusion Study and Metallogeny Review of Gold Deposits in Western Hunan District"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 114-120

TEXT OF ENGLISH ABSTRACT: One hundred seventeen samples from gold deposits were taken up and their fluid inclusion has been studied. The scope of this study comprises the following contents:
(1) sizes, forms and characteristics of gas/liquid ratios;
(2) the determination of the fluid temperatures from the field observation combined with experimental work by means of homogenization and explosion methods. Here this process was divided into four metallogenetic stages. The conclusion is primarily about the paragenesis of major minerals. And the flow directions of mineral fluid have also been predicted.
(3) the study of the composition of inclusions and salinity. The gases are composed of H_2O, CO_2, CO, O_2, H_2, N_2, CH_4, C_2H_2, C_2H_4. The composition of the liquids is the compounds of K^+, Na^+, Ca^{2+}, Mg^{2+}, F^-, Cl^-, SO_4^{2-}, etc. The contents of

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heavy metals in the inclusions are Cu, Pb, Cr, Fe, Mn, Au, etc. The concentrations of salts have all been counted and the values of pH and Eh have been determined.

Based on the data of field inclusion study and field geological observation, it can be recognized that the metallogeny of gold deposits in western Hunan district is formed by the permeable mesothermal to epithermal ore fluids.

AUTHOR: LI Shifeng [2621 0013 6265]

ORG: Department of Chemistry

TITLE: "Formulas for Calculating Atomic Radii"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, Jun 81 pp 121-126

TEXT OF ENGLISH ABSTRACT: Formulas for calculating the ionic radii, covalent radii, Van der Waals radii and metallic radii from the atomic number are presented.

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CSO: 4009/57

Shipbuilding

AUTHOR: SHENG Zhenbang [4141 2182 6721]
ZHANG Yuncai [1728 0061 1752]
YANG Akang [2799 7093 1660]

ORG: All of Shanghai Jiaotong University

TITLE: "Model Wake Measurement and Wake Quality Assessment"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 1-13

TEXT OF ENGLISH ABSTRACT: The present paper introduces the first part of the research program "Ship Wake Field and Propeller Excited Vibration" carried out at the Ship Hydrodynamics Laboratory of Shanghai Jiaotong University. The instrumentation and method for model wake measurement, wake quality assessment from the point of view of propeller excited vibration are described. In addition, examples of measured results of two models are given in this paper.

AUTHOR: LU Huisheng [7120 1920 3932]
ZHU Wenwei [2612 2429 5588]
FEI Naizhen [6316 0035 2182]
WANG Wenfu [3769 2429 1381]

ORG: All of Shanghai Jiaotong University

TITLE: "Model Wake Measurement and Wake Quality Assessment"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 15-36

TEXT OF ENGLISH ABSTRACT: The present paper introduces the experiments of open rudders carried out at the ship model towing tank of Shanghai Jiaotong University. The main purpose of such experiments is to study the influence of the Reynolds number, depth of immersion, aspect ratio and thickness ratio on the rudder performance. In addition, the comparative experiments are briefly introduced. All the experimental results are given in diagrams. Based on the experimental results and comparison of some existing formulas, the following new formula

$$C_N = K \frac{6}{1 + \frac{2}{\lambda}} \alpha + \alpha \sin^2\alpha$$

for estimating the normal rudder force is proposed.

AUTHOR: WU Xiongjian [0702 7160 1696]

ORG: Shanghai Jiaotong University

TITLE: "Theoretical Estimates and Experimental Methods of the Parameters of Flume Stabilizers"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 37-54

TEXT OF ENGLISH ABSTRACT: For lack of adequate theoretical methods, predictions of flume tank performances are mainly based on experimental means. Based on Watanabe's theory and other different methods given by Goodrich, Lewison and Webster, respectively, the present paper develops a comprehensive model for this stabilizer. Therefore, a tank natural-period formula is derived and tank damping can be estimated theoretically. Attempts to establish simplified roll equations for the tank-ship system without any unknown coefficients are made.

Tank-water motion:

$$\ddot{\tau} + W|\dot{\tau}|\dot{\tau} + \omega_0^2\tau = \omega_0^2\left(\varphi - \frac{H}{g}\ddot{\varphi}\right)$$

Ship roll:

$$\ddot{\varphi} + 2\nu_\varphi\dot{\varphi} + \omega_\varphi^2\varphi - \frac{M_t}{I_\varphi}\tau = \omega_\varphi^2\alpha_m\sin(\omega t + \varepsilon)$$

Period coefficient

$$\lambda = \sqrt{1 + 2r(s-b)\left(\frac{\pi}{4} + \frac{l}{b}\right)\left(\frac{\pi}{B}\right)^2}$$

[Continuation of SHANGHAI JIAOTONG DAXUE XUEBAO No 2, May 81 pp 37-54]

Damping coefficient $W = \frac{l+r}{2h_0}\left(\frac{\pi}{\lambda\cos\frac{\omega_0 l}{c_0}} \cdot \frac{2r}{B}\right)^2\left[2\left(2.23\frac{b}{r} + 1\right)\lg\left(\frac{s}{b} + \frac{1}{2}\right)^2 + 1.5\left(\frac{s}{b}\right)^2\right]$

Anti-rolling moment coefficient

$$M_t = 2\rho g(l+r)\left[2rs\frac{c_0}{\omega_0}\left(\mathrm{tg}\frac{\omega_0 l}{c_0} + \mathrm{tg}\frac{\omega_0 r}{c_0}\right) + \frac{b(Hh_2 - h_2^2/2)}{\cos\frac{\omega_0 r}{c_0}}\right]$$

A specially designed device is used to measure these parameters through the "decaying-motion-moment method" and the forced oscillation test. Experimental results when compared with the relative theoretical values are so inspiring that it is considered possible to design an optimum flume tank for a ship and predict its performances theoretically.

AUTHOR: JIN Dexian [6855 1795 6343]
GU Yongning [7357 3057 1380]
LI Runpei [2621 3387 1014]
HEN Jiwen [7281 4949 2429]

ORG: All of Shanghai Jiaotong University

TITLE: "Static Analysis of Mooring Systems of Semisubmersible Drilling Units"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 55-65

TEXT OF ENGLISH ABSTRACT: Properties of a static anchor chain curve are described by means of catenary theory. The nonlinear displacement stiffness coefficient of the anchor curve and resultant stiffness performance of spread mooring systems are presented. Based on this the numerical solution of static analysis of spread mooring systems is then found. The application of the method is illustrated by the analysis of mooring system of the semisubmersible drilling unit *Nanhai*-2.

AUTHOR: ZHOU Jian [0719 0256]
JIANG Ciping [1203 2945 1627]
SHENG Zhenbang [4141 2182 6721]
et al.

ORG: All of Shanghai Jiaotong University

TITLE: "Experimental Investigation of Geosims"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 67-83

TEXT OF ENGLISH ABSTRACT: This paper describes briefly the experimental results of resistance tests, propeller open water tests and self-propulsion tests of five geometrically similar models of a 24,000 DWT oil tanker. The tests were carried out at the Ship Hydrodynamics Laboratory of Shanghai Jiaotong University. The following conclusions reached on the basis of the analysis of experimental results may be useful for future reference in ship model experimental research.
(1) The form factor method (three-dimens [illegible] method) is more reasonable that the traditional Froude's method (two-dimens. [illegible] method) for extrapolating the model to ship resistance.
(2) There is an appreciable scale effect on wake fraction, and the wake fraction decreases as the size of models increases.

[Continuation of SHANGHAI JIAOTONG DAXUE XUEBAO No 2, May 81 pp 67-83]

(3) The scale effect on thrust deduction coefficient is small, which may be considered approximately constant for models greater than 5 meters in length.
(4) The relative rotative efficiency decreases as the size of models decreases, but its scale effect can be neglected when the diameter of the model propeller is greater than 120 mm and the length of the ship model is longer than 4 meters.

AUTHOR: QIN Shiyuan [4440 1102 0337]

ORG: Shanghai Jiaotong University

TITLE: "A Discussion of the Penalty Term of an Optimization Algorithm by External Penalty Technique with Pattern Searches"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 85-98

TEXT OF ENGLISH ABSTRACT: An optimization algorithm and computer program using the external penalty technique with pattern search methods were presented previously by Parsons. In this paper a discussion is made of its penalty term and samples of numerical test problems are given. By the modification of the loss function into a quadratic type, the result has been significantly improved.

AUTHOR: CAO Meiliang [2580 2734 0081]
XIA Taichun [1115 3141 3196]
LIU Yueyuan [0491 1471 0337]
ZHOU Fengbin [0719 7685 2430]

ORG: All of Shanghai Jiaotong University

TITLE: "The Influence of Backing Rudder System on the Open Water Performance of Ducted Propeller"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 99-124

TEXT OF ENGLISH ABSTRACT: In this paper, the results of open water tests of ducted propeller JD8001-70 + Ka4-70 (P/D = 1.0) are given. The duct JD8001, on which a steering rudder, two backing rudders and a strut are mounted, is based on the duct JD7704. The optimum initial angles of the backing rudders and the $\sqrt{B_p-\delta}$ charts corresponding to these angles are given. In addition, some comments on the design of ducted propellers with the backing rudder system of a typical push-boat are made.

AUTHOR: WANG Xiangbao [3076 1651 1405]
SHI Depei [2457 1795 1014]
ZHU Fugen [2612 4395 2704]
LI Longyuan [2621 7893 3220]

ORG: All of Shanghai Jiaotong University

TITLE: "Finite Element Static Analysis of Support Ring Model with Clearance"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 125-136

TEXT OF ENGLISH ABSTRACT: A structure assembled by a sphere, cone and cylinder with support ring was calculated using the finite element axisymmetrical analysis program. It is known that connection of a support ring to a cylinder is somewhat unusual, i.e., along the contact line between the support ring and cylinder, only the ends are welded while the rest face each other. Consequently, they used to be taken as a solid entirety in the calculation, resulting in the fact that the calculation results were not in agreement with the experimental ones. A support ring model with clearance which is capable of exhibiting the feature of the connection between them is presented. The calculated results show that stresses and strains are in good agreement with the experimental ones, and that the calculating model and method are available. As a result, a reasonable explanation why previous results were not so satisfactory has been made.

AUTHOR: XIAO Xi [5135 3356]
YU Baohai [0060 1405 3189]

ORG: Both of Shanghai Jiaotong University

TITLE: "Optimum Design of Tanker Longitudinal Members"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 137-148

TEXT OF ENGLISH ABSTRACT: Optimum design procedure of tanker longitudinal members is used for the two tankers (15,000 tonnage and 50,000 tonnage) constrained by the 1973 Chinese Rules for the construction of sea-going steel ships.

The present article analyzes the variation of the structural weight resulting from the change of longitudinal spacing or longitudinal span. The standardization for the optimum results is performed so that the results are available for use. The computative results show that the weight of tanker longitudinal members is reduced by about 5 percent as a result of optimization.

The article proposes and applies a partially improved SCDD optimum method. This method takes accelerative measures when the optimum point is searched along the negative gradient of synthetical constraint function by the SCDD method. Therefore, the computative speed is increased and better results have been obtained.

AUTHOR: YANG Daisheng [2799 0108 4141]

ORG: Shanghai Jiaotong University

TITLE: "Probabilistic Approach to the Estimation of Ship Strength"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 149-156

TEXT OF ENGLISH ABSTRACT: For convenience, a weibull function is taken as the probability density function of the wave bending stress in ship structure as was done by Alaa Mansour and others. The probability of ship failure is derived on the assumption that, as the total stress is beyond the yield point of hull steel, the failure of ship structure will occur while taking account of the random characters of the mechanical properties of hull steel. This probability can be applied to the estimation of ship strength.

AUTHOR: YANG Zongying [2799 1350 5391]

ORG: Shanghai Jiaotong University

TITLE: "Stability Cross Curve Programming System of the Mobile Drilling Units"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 157-172

TEXT OF ENGLISH ABSTRACT: The main differences in stability analysis between the mobile drilling units and normal ships are described in the present paper. The mathematical models, calculation methods and principles of the stability cross curve for the semisubmersible drilling platforms with hulls and caissons and jack-up drilling platform are presented. Based on this, the computer program is formulated. Transverse, longitudinal and diagonal stability cross curves are calculated for the semisubmersible drilling platform with lower hulls. In the case of the semisubmersible drilling platform with caissons and the jack-up drilling platform, the stability dross curves are calculated at every 15° from 0-180° in the direction of the X-axis. Two calculation examples are provided, and the calculating method is more convenient to follow, which may be applied to the engineering calculation, especially to preliminary designs, though it is found that the results are not in as good agreement as would be expected from the hand calculations.

AUTHOR: ZHU Yonge [2612 3057 8340]
WANG Xiling [3076 1585 7881]

ORG: Both of Shanghai Jiaotong University

TITLE: "The Criterion of U or V Degree of Forebody Sections of Ships"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 173-186

TEXT OF ENGLISH ABSTRACT: In this paper a parameter relating to the U or V degree of forebody sections of ships is obtained by analyzing the hull form information of several well-known series of ship models and a few actual ships. The presented measure number d derived from this parameter may be used to judge the U or V degree of forebody sections of ships with different fullness. In designing an ordinary ship form, particularly in the case of computer-aided design, the desirable U or V degree of forebody sections can be managed in advance by fixing a corresponding measure number.

Some examples given at the end of this paper illustrate its application with excellent results.

AUTHOR: CHEN Tieyun [7115 6993 0061]
ZHANG Shengkun [1728 5110 0981]
QIAN Rengji [6929 3095 0529]

ORG: All of Shanghai Jiaotong University

TITLE: "The Review and Development of a Ship's Computational Structural Mechanics"

SOURCE: Shanghai SHANGHAI JIAOTONG DAXUE XUEBAO [JOURNAL OF SHANGHAI JIAOTONG UNIVERSITY] in Chinese No 2, May 81 pp 187-199

TEXT OF ENGLISH ABSTRACT: In this paper, the situation of the finite element method in analysis of ship structures has been reviewed. In addition, the prospect of a ship's computational structural mechanics is given and, especially, the new methods of design and analysis of ship structures, the development of numerical methods, structural optimization and structural analysis program of general purpose are introduced.

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